

ABSTRACT OF THE DISCLOSURE

A light-driven energy generation system using proteorhodopsin is provided. Proteorhodopsin sequences were retrieved and amplified from naturally occurring members of the domain Bacteria using proteorhodopsin-specific polymerase chain reaction primers. Proteorhodopsin sequences were placed in expression vectors for production of proteorhodopsin proteins in a host, for instance, *E. coli* and other bacteria. The system also includes a light source and a source of retinal, that allows the system to convert light into biochemical energy. The generated biochemical energy could be mediated into electrical energy by a mediator.

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DEPOSITS

Depository address: 10801 University Boulevard, Manassas, VA 20110.

The Escherichia coli containing cloned DNA BAC 31A8 having assigned ATCC number PTA-3083, the Escherichia coli containing cloned DNA BAC 40E8 having assigned ATCC number PTA-3082, the Escherichia coli containing cloned DNA BAC 41B4 having assigned ATCC number PTA-3080, and the Escherichia coli containing cloned DNA BAC 64A5 having assigned ATCC number PTA-3081, all having been deposited on February 21, 2001 with the ATCC Patent Depository.

20 The Escherichia coli containing a plasmid PAL E6 having assigned ATCC number PTA-3250, the Escherichia coli containing a plasmid HOT 0m1 having assigned ATCC number PTA-3251, the Escherichia coli containing a plasmid HOT 75m4 having assigned ATCC number PTA-3252, and the Escherichia coli containing cloned DNA BAC64A5 having assigned ATCC number PTA 3082, all having been deposited on March 30, 2001 with the
25 ATCC Patent Depository.

LIGHT-DRIVEN ENERGY GENERATION USING PROTEORHODOPSIN

LIST OF SEQUENCES THAT ARE LISTED IN THE INCORPORATED SEQUENCE LISTING

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Sequence ID No:1 bacterial artificial chromosome (BAC) clone 31A8 (EBAC31A8).

Sequence ID No:2 nucleotide sequence of proteorhodopsin-specific polymerase chain reaction (PCR) primer 1.

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Sequence ID No:3 nucleotide sequence of proteorhodopsin-specific polymerase chain reaction (PCR) primer 2.

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Sequence ID No:4 nucleotide sequence of the proteorhodopsin gene amplified from clone EBAC31A8 (Sequence ID No. 1) using PCR primers according to Sequence ID No:2 and Sequence No:3.

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Sequence ID No:5 deduced amino acid sequences of the proteorhodopsin gene amplified from clone EBAC31A8 (Sequence ID NO:4).

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Sequence ID No:6 native proteorhodopsin nucleotide sequence from clone EBAC31A8 (Sequence ID No:1).

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Sequence ID No:7 deduced amino acid sequences of the native proteorhodopsin nucleotide sequence from clone EBAC31A8 (Sequence ID No:6).

Sequence ID No:8 nucleotide sequence of the proteorhodopsin gene amplified from clone EBAC40E8 using PCR primers according to Sequence ID No:2 and Sequence No:3.

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Sequence ID No:9 deduced amino acid sequences of the proteorhodopsin gene amplified from clone EBAC40E8 (Sequence ID NO:8).

Sequence ID No:10 nucleotide sequence of the proteorhodopsin gene amplified from clone EBAC41B4 using PCR primers according to Sequence ID No:2 and Sequence No:3.

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Sequence ID No:11 deduced amino acid sequences of the proteorhodopsin gene amplified from clone EBAC41B4 (Sequence ID NO:10).

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Sequence ID No:12 nucleotide sequence of the proteorhodopsin gene amplified from clone EBAC64A5 using PCR primers according to Sequence ID No:2 and Sequence No:3.

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Sequence ID No:13 deduced amino acid sequences of the proteorhodopsin gene amplified from clone EBAC64A5 (Sequence ID NO:12).

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Sequence ID No:14 nucleotide sequence of the proteorhodopsin gene amplified from clone HOT0m1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:15 deduced amino acid sequences of the proteorhodopsin gene amplified from clone HOT0m1 (Sequence ID NO:14).

5 **Sequence ID No:16** nucleotide sequence of the proteorhodopsin gene amplified from clone HOT75m1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

10 **Sequence ID No:17** deduced amino acid sequences of the proteorhodopsin gene amplified from clone HOT75m1 (Sequence ID NO:16).

15 **Sequence ID No:18** nucleotide sequence of the proteorhodopsin gene amplified from clone HOT75m3 using PCR primers according to Sequence ID No:2 and Sequence No:3.

20 **Sequence ID No:19** deduced amino acid sequences of the proteorhodopsin gene amplified from clone HOT75m3 (Sequence ID NO:18).

25 **Sequence ID No:20** nucleotide sequence of the proteorhodopsin gene amplified from clone HOT75m4 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:21 deduced amino acid sequences of the proteorhodopsin gene amplified from clone HOT75m4 (Sequence ID NO:20).

Sequence ID No:22 nucleotide sequence of the proteorhodopsin gene amplified from clone HOT75m8 using PCR primers according to Sequence ID No:2 and Sequence No:3.

5 **Sequence ID No:23** deduced amino acid sequences of the proteorhodopsin gene amplified from clone HOT75m8 (Sequence ID NO:22).

10 **Sequence ID No:24** nucleotide sequence of the proteorhodopsin gene amplified from clone MB0m1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

15 **Sequence ID No:25** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB0m1 (Sequence ID NO:24).

20 **Sequence ID No:26** nucleotide sequence of the proteorhodopsin gene amplified from clone MB0m2 using PCR primers according to Sequence ID No:2 and Sequence No:3.

25 **Sequence ID No:27** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB0m2 (Sequence ID NO:26).

Sequence ID No:28 nucleotide sequence of the proteorhodopsin gene amplified from clone MB20m2 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:29 deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB20m2 (Sequence ID NO:28).

5 **Sequence ID No:30** nucleotide sequence of the proteorhodopsin gene amplified from clone MB20m5 using PCR primers according to Sequence ID No:2 and Sequence No:3.

10 **Sequence ID No:31** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB20m5 (Sequence ID NO:30).

15 **Sequence ID No:32** nucleotide sequence of the proteorhodopsin gene amplified from clone MB20m12 using PCR primers according to Sequence ID No:2 and Sequence No:3.

20 **Sequence ID No:33** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB20m12 (Sequence ID NO:32).

25 **Sequence ID No:34** nucleotide sequence of the proteorhodopsin gene amplified from clone MB40m1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

30 **Sequence ID No:35** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB40m1 (Sequence ID NO:34).

Sequence ID No:36 nucleotide sequence of the proteorhodopsin gene amplified from clone MB40m5 using PCR primers according to Sequence ID No:2 and Sequence No:3.

5 **Sequence ID No:37** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB40m5 (Sequence ID NO:36).

10 **Sequence ID No:38** nucleotide sequence of the proteorhodopsin gene amplified from clone MB40m12 using PCR primers according to Sequence ID No:2 and Sequence No:3.

15 **Sequence ID No:39** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB40m12 (Sequence ID NO:38).

20 **Sequence ID No:40** nucleotide sequence of the proteorhodopsin gene amplified from clone MB100m5 using PCR primers according to Sequence ID No:2 and Sequence No:3.

25 **Sequence ID No:41** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB100m5 (Sequence ID NO:40).

Sequence ID No:42 nucleotide sequence of the proteorhodopsin gene amplified from clone MB100m7 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:43 deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB100m7 (Sequence ID NO:42).

5 **Sequence ID No:44** nucleotide sequence of the proteorhodopsin gene amplified from clone MB100m9 using PCR primers according to Sequence ID No:2 and Sequence No:3.

10 **Sequence ID No:45** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB100m9 (Sequence ID NO:44).

15 **Sequence ID No:46** nucleotide sequence of the proteorhodopsin gene amplified from clone MB100m10 using PCR primers according to Sequence ID No:2 and Sequence No:3.

20 **Sequence ID No:47** deduced amino acid sequences of the proteorhodopsin gene amplified from clone MB100m10 (Sequence ID NO:46).

25 **Sequence ID No:48** nucleotide sequence of the proteorhodopsin gene amplified from clone PALB1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

30 **Sequence ID No:49** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB1 (Sequence ID NO:48).

Sequence ID No:50 nucleotide sequence of the proteorhodopsin gene amplified from clone PALB2 using PCR primers according to Sequence ID No:2 and Sequence No:3.

5 **Sequence ID No:51** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB2 (Sequence ID NO:50).

10 **Sequence ID No:52** nucleotide sequence of the proteorhodopsin gene amplified from clone PALB5 using PCR primers according to Sequence ID No:2 and Sequence No:3.

15 **Sequence ID No:53** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB5 (Sequence ID NO:52).

20 **Sequence ID No:54** nucleotide sequence of the proteorhodopsin gene amplified from clone PALB7 using PCR primers according to Sequence ID No:2 and Sequence No:3.

25 **Sequence ID No:55** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB7 (Sequence ID NO:54).

Sequence ID No:56 nucleotide sequence of the proteorhodopsin gene amplified from clone PALB6 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:57 deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB6 (Sequence ID NO:56).

5 **Sequence ID No:58** nucleotide sequence of the proteorhodopsin gene amplified from clone PALB8 using PCR primers according to Sequence ID No:2 and Sequence No:3.

10 **Sequence ID No:59** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALB8 (Sequence ID NO:58).

15 **Sequence ID No:60** nucleotide sequence of the proteorhodopsin gene amplified from clone PALE1 using PCR primers according to Sequence ID No:2 and Sequence No:3.

15 **Sequence ID No:61** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALE1 (Sequence ID NO:60).

20 **Sequence ID No:62** nucleotide sequence of the proteorhodopsin gene amplified from clone PALE6 using PCR primers according to Sequence ID No:2 and Sequence No:3.

Sequence ID No:63 deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALE6 (Sequence ID NO:62).

- Sequence ID No:64** nucleotide sequence of the proteorhodopsin gene amplified from clone PALE7 using PCR primers according to Sequence ID No:2 and Sequence No:3.
- 5 **Sequence ID No:65** deduced amino acid sequences of the proteorhodopsin gene amplified from clone PALE7 (Sequence ID NO:64).